

WHAT IS CLAIMED IS:

1. An automatic transmission system for a vehicle, comprising:
  - an automatic transmission including a torque converter provided with a lockup clutch; and
    - 5 a controller that controls, while the vehicle is coasting in a fuel-cut state, an oil pressure of the lockup clutch through a feedback control using a hydraulic device so that a slip rotation speed of the lockup clutch matches a target slip rotation speed, wherein
      - the controller is adapted to calculate the slip rotation speed of the lockup clutch, and control the hydraulic device so that the oil pressure of the lockup clutch becomes constant if the slip rotation speed calculated is greater than a predetermined rotation speed during a downshift of the automatic transmission.
  - 10 2. An automatic transmission system for a vehicle, comprising:
    - an automatic transmission including a torque converter provided with a lockup clutch; and
      - 15 a controller that controls, while the vehicle is coasting in a fuel-cut state, an oil pressure of the lockup clutch through a feedback control using a hydraulic device so that a slip rotation speed of the lockup clutch matches a target slip rotation speed, wherein
        - 20 the controller is adapted to execute an oil pressure fixing control of fixing the oil pressure of the lockup clutch if a downshift of the automatic transmission is executed, and
          - the controller is further adapted to calculate the slip rotation speed of the lockup clutch, and stop the oil pressure fixing control if the slip rotation speed calculated is less than a predetermined rotation speed while the oil pressure fixing control is being executed.
    - 30 3. An automatic transmission system for a vehicle, comprising:
      - an automatic transmission including a torque converter provided with a lockup clutch; and
        - a controller that controls, while the vehicle is coasting in a fuel-cut state, an oil pressure of the lockup clutch through a feedback control using a hydraulic device so

that a slip rotation speed of the lockup clutch matches a target slip rotation speed, wherein

the controller is adapted to calculate the slip rotation speed of the lockup clutch, and set the calculated slip rotation speed as the target slip rotation speed if a  
5 downshift of the automatic transmission is executed.

4. The automatic transmission system according to claim 3, wherein the controller is further adapted to set the calculated slip rotation speed as the target slip rotation speed if the calculated slip rotation speed is greater than a predetermined  
10 rotation speed during the downshift of the automatic transmission.

5. The automatic transmission system according to claim 3, wherein the controller is further adapted to set the predetermined rotation speed as the target slip rotation speed if the calculated slip rotation speed is less than the predetermined  
15 rotation speed during the downshift of the automatic transmission.

6. The automatic transmission system according to claim 3, wherein the controller is further adapted to converge the target slip rotation speed to a target slip rotation speed of a steady coasting run if a predetermined converging condition has  
20 been met.

7. A control apparatus for an automatic transmission for a vehicle including a torque converter provided with a lockup clutch, the control apparatus being able to control, while the vehicle is coasting in a fuel-cut state, an oil pressure of the lockup  
25 clutch through a feedback control using a hydraulic device so that a slip rotation speed of the lockup clutch matches a target slip rotation speed, the control apparatus comprising:

calculation means for calculating the slip rotation speed of the lockup clutch;  
and

30 control means for controlling the hydraulic device so that the oil pressure of the lockup clutch becomes constant if the slip rotation speed calculated is greater than a predetermined rotation speed during a downshift.

8. A control apparatus for an automatic transmission for a vehicle including a torque converter provided with a lockup clutch, the control apparatus being able to control, while the vehicle is coasting in a fuel-cut state, an oil pressure of the lockup clutch through a feedback control using a hydraulic device so that a slip rotation speed of the lockup clutch matches a target slip rotation speed, and execute an oil pressure fixing control of fixing the oil pressure if a downshift of the automatic transmission is executed, the control apparatus comprising:

calculation means for calculating the slip rotation speed of the lockup clutch; and:

10 stop means for stopping the oil pressure fixing control if the slip rotation speed calculated is less than a predetermined rotation speed while the oil pressure fixing control is being executed.

9. A control apparatus for an automatic transmission for a vehicle including a torque converter provided with a lockup clutch, the control apparatus being able to control, while the vehicle is coasting in a fuel-cut state, an oil pressure of the lockup clutch through a feedback control using a hydraulic device so that a slip rotation speed of the lockup clutch matches a target slip rotation speed, the control apparatus comprising:

20 calculation means for calculating the slip rotation speed of the lockup clutch; and

first rotation speed setting means for setting the calculated slip rotation speed as the target slip rotation speed if a downshift of the automatic transmission is executed.

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10. A control method for controlling a lockup clutch of a torque converter while a vehicle equipped with an automatic transmission is coasting in a fuel-cut state, wherein an oil pressure of the lockup clutch is controlled through a feedback control so that a slip rotation speed of the lockup clutch matches a target slip rotation speed, the control method comprising the steps of:

calculating the slip rotation speed of the lockup clutch; and

controlling the oil pressure of the lockup clutch to be constant if the slip rotation speed calculated is greater than a predetermined rotation speed during a downshift.

11. A control method for controlling a lockup clutch of a torque converter while a vehicle equipped with an automatic transmission is coasting in a fuel-cut state, wherein an oil pressure of the lockup clutch is controlled through a feedback control  
5 so that a slip rotation speed of the lockup clutch matches a target slip rotation speed, the control method comprising the steps of:

executing an oil pressure fixing control of fixing the oil pressure if a downshift of the automatic transmission is executed;

calculating the slip rotation speed of the lockup clutch; and

10 stopping the oil pressure fixing control if the slip rotation speed calculated is less than a predetermined rotation speed while the oil pressure fixing control is being executed.

12. A control method for controlling a lockup clutch of a torque converter while a vehicle equipped with an automatic transmission is coasting in a fuel-cut state, wherein an oil pressure of the lockup clutch is controlled through a feedback control so that a slip rotation speed of the lockup clutch matches a target slip rotation speed, the control method comprising the steps of:

calculating the slip rotation speed of the lockup clutch; and

20 setting the calculated slip rotation speed as the target slip rotation speed if a downshift of the automatic transmission is executed.

13. The control method according to claim 12, wherein the calculated slip rotation speed is set as the target slip rotation speed if the calculated slip rotation  
25 speed is greater than a predetermined rotation speed during the downshift of the automatic transmission.

14. The control method according to claim 12, wherein the predetermined rotation speed is set as the target slip rotation speed if the calculated slip rotation  
30 speed is less than the predetermined rotation speed.

15. The control method according to claim 12, wherein the target slip rotation speed is set to a target slip rotation speed suitable for a steady coasting of the vehicle if a predetermined condition has been met.